Environmental Protection Agency

Laminar Flow Verification Procedure

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NVFEL Reference Number

027

Implementation Approval

Original Procedure Authorized by EPC #260 on 09-28-2001

Revision Description

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1. Purpose

The purpose of this working procedure is to describe the equipment and steps necessary to perform a Engine Intake Air Laminar Flow Element (LFE) verification.

2. Test Procedure

101 Go to room 339 and unlock the storage cage. Locate the Merian Instrument LFE Verification cart. See Figure 1. Move the cart to the room that has the LFE to be verified. Position the cart in close proximity to that LFE.

Figure 1
LFE Prover

102 Disconnect the rubber boot from the LFE to be verified.

103 Attach the extension hose that is stored in the bottom of the cart to the LFE to be verified. See Figure 2.

Figure 2
Verification Extension Hose

104 Also stored in the bottom of the cart is the Verification LFE. Remove the protective caps from the Verification LFE.

105 Locate the air-flow arrow indicator on the Verification LFE. Attach the Verification LFE to the extension hose ensuring that arrow points toward the engine. See the yellow arrow in Figure 4.

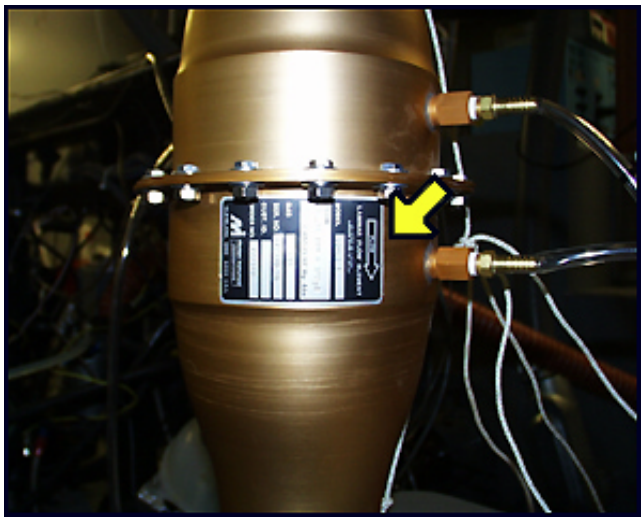

Figure 3
Verification Standard LFE

106 Attach the rubber boot that you disconnected from the LFE in Step 102 to the open end of the Verification LFE. See the arrow in Figure 4.

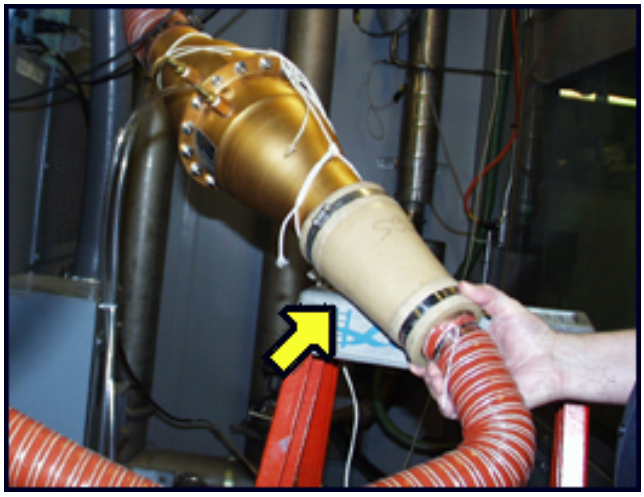

Figure 4
Attach Rubber Boot

107 If necessary, suspend the Verification LFE in a safe position so it does not put undo tension on the LFE hose connection. Be careful not to bend the hoses to restrict air flow.

108 Connect the tube with the black banded line to Hi Pr transducer pressure port (See arrow 1 in Figure 5) and the unmarked tube to Lo PR port (See arrow 2 in Figure 5) on the front of the LFE Verification instrument panel.

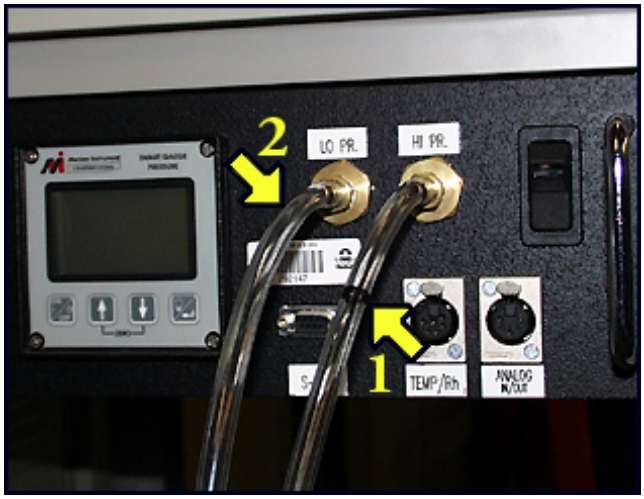

Figure 5
Transducer Pressure Lines

109 Attach the Temp/RH sensor to the LFE air intake filter. Ensure that the sensor tip is in the air flow. See the arrow in Figure 6.

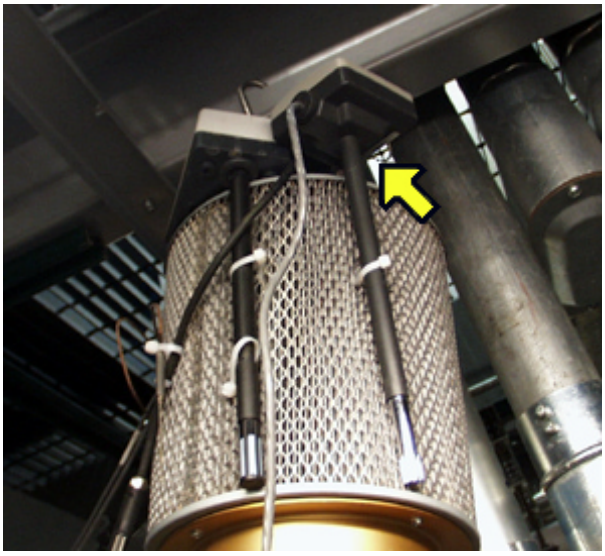

Figure 6
Temp/RH Sensor

110 Connect the other end of the Temp/RH Transmitter into the Temp/RH plug on the LFE Verification instrument panel. See the arrow in Figure 7.

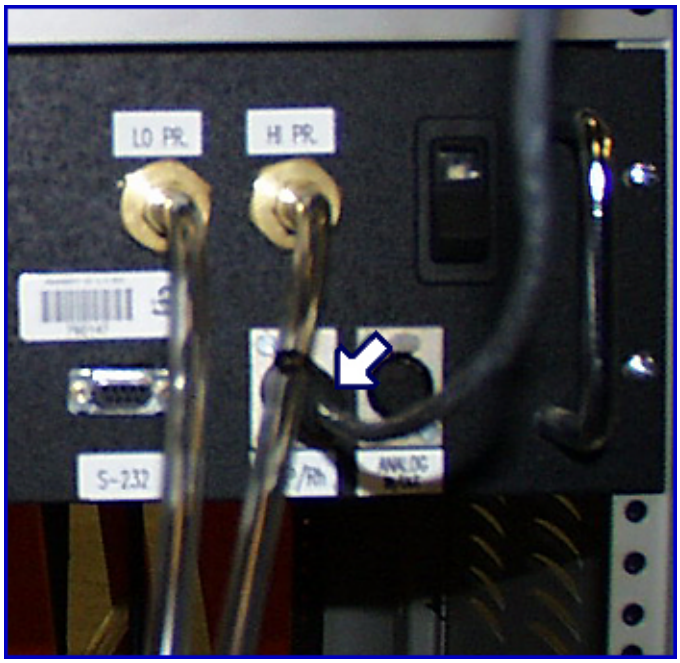

Figure 7
Temp/RH Transmitter connection

111 Plug the LFE Verification instrument into an AC receptacle and turn it on.

112 Verify that a flow rate value appears on the FI display of the LFE Verification instrument. See the arrow in Figure 8. If a flow rate is not indicated, verify that all connections and power requirements are correct. If they are, contact a senior technician for assistance.

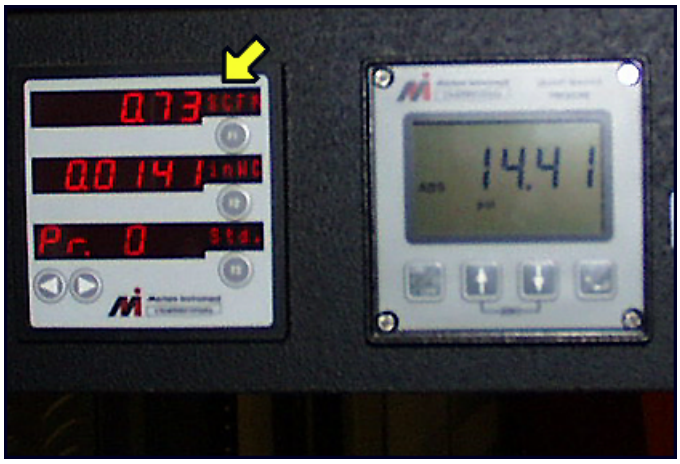

Figure 8
LFE Prover Panel F1 Display

113 Allow the LFE Verification instrument to warm-up for a minimum of 30 minutes.

114 Position the cart in the test cell to permit the LFE Verification instrument panel displays to be observed from the control room while the engine is running.

115 In the control room, follow WP 031, "Start VX-IN" procedure to start the VX-IN equipment. Go to the Data Processing Computer and sign on by entering the user name and password.

116 From the “C” drive, open the “Calibration” folder and select the “LFE Calibration/Verification Worksheet.” Print a blank copy of the worksheet.

117 On the “Digital Flow Totalizer” keypad, press <enter>. See arrow 1 in Figure 9. Then press <p>. See arrow 2 in Figure 9.

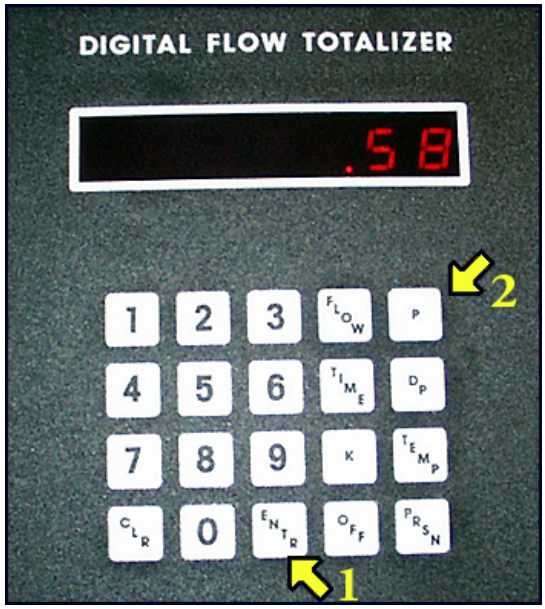

Figure 9
Digital Flow Totalizer Keypad

118 On the MTS computer, elect the “Launch” the engine according to WP 007, "Engine Test." See the arrow in Figure 10.

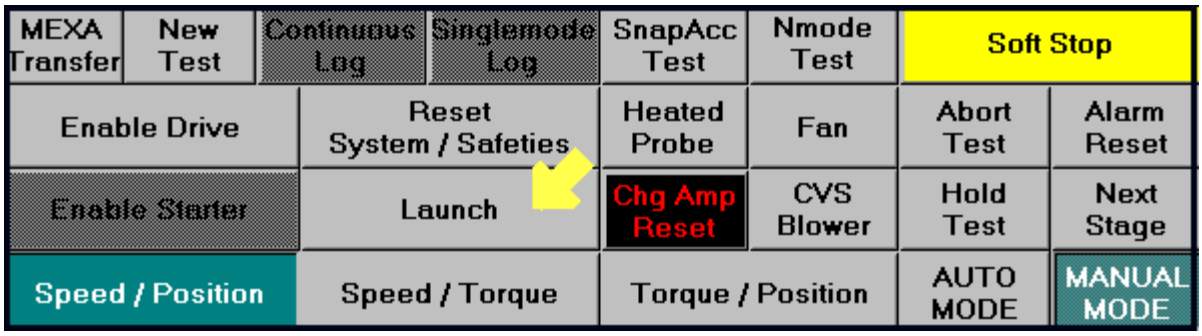

Figure 10
Launch

119 Operate the engine at low, medium and high rpm while observing the front panel on the LFE Verification instrument and "QV Engine Intake" on the MTS Computer screen. Verify that both are reading a flow rate.

119 One point at a time, set the engine rpm to the following four data points, 2000 rpm, 2500 rpm, 3000 rpm, and 3500rpm. On the LFE Calibration/Verification Worksheet, record the Standard Flow (SCFM) , from the Verification LFE and LFE Flow (SCFM) readings from the MTS computer. See Figure 11. The flow rate reading from the MTS computer must be within 2% of the Verification LFE flow rate. If not, contact a senior technician.

LFE Calibration Worksheet				
Point	Engine RPM	Standard Flow (SCFM)	LFE Flow (SCFM)	% Difference
1	2000	68.1	69.2	1.6%
2	2500	83.2	84.4	1.4%
3	3000	113.4	114.9	1.3%
4	3500	126.0	127.5	1.2%
% Difference should not exceed plus or minus 2.0 %.				

Figure 11
LFE Calibration Worksheet

120 Go to the Data Processing Computer and sign on by entering the user name and password.

121 From the “C” drive, open the “Calibration” folder and select the “LFE Calibration Worksheet.”

122 On the LFE Calibration Worksheet, record the Standard Flow (SCFM) and LFE Flow (SCFM) readings taken in Step 119. The % Difference will automatically displayed. The flow rate reading from the MTS computer must be within 2% of the Verification LFE flow rate. If not, contact a senior technician.

123 Print the LFE Calibration Worksheet.

124 File the document in the site calibration records storage cabinet.

125 Stop the engine following the standard shut down procedure.

126 Follow WP 032, "Start VX-IN System Shutdown” procedure to shut down the VX-IN equipment.

127 In the test cell, turn off the power to the LFE Verification instrument and unplug it from the outlet.

127 Remove the Temp/RH plug and the two transducer pressure lines from the LFE Verification instrument panel. Do not disconnect the pressure lines from the Verification LFE.

128 Remove the Temp/RH sensor from the LFE air intake filter.

129 Disconnect the rubber boot from the Verification LFE.

130 Disconnect the Verification LFE from the extension tube. Replace the end caps on the Verification LFE and store on the LFE Verification cart.

131 Disconnect the extension tube from the LFE and store it in the LFE Verification cart.

132 Attach the rubber boot to the LFE. Make sure all connections are tight.

133 Return the LFE Verification cart to the Room 329 storage cage.

3. Acceptance Criteria

3.1 The LFE Verification instrument must warm-up for a minimum of 30 minutes.

3.3 All connection must be leak tight.

3.2 The flow rate reading from the MTS computer must be within 2% of the Verification LFE flow rate.